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# BOVINE TUBERCULOSIS.

By ARCHIBALD R. WARD AND CLARENCE M. HARING.



A TUBERCULIN TEST OUTFIT.

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# THE TUBERCULOSIS PROBLEM.

BY A. R. WARD AND C. M. HARING.

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Bovine tuberculosis is a menace that no stock raiser or dairyman can afford to ignore. There is no problem confronting agriculture to-day of more fundamental importance than that constituted by this disease.

Tuberculosis shortens the life of cows. Exact data on this point is not available, but we have the statement of an experienced San Francisco dairyman that tuberculosis shortens the average productive life of cows by one half. It unquestionably reduces the efficiency of a herd as a machine for producing milk from feed. When its existence may be detected, the market value of the animal is obliterated, and the reputation of the breeder of fine stock is injured by general knowledge of its presence in his herd.

Tuberculosis saps the profits of the cattle business by rendering beef unwholesome for human food. The extension of the practice of thorough meat-inspection is gradually closing the avenues for the profitable disposal of animals seriously affected with tuberculosis. Contrary to general belief, range cattle are far from safe from tuberculosis. Those range herds, recruited from dairies, show a relatively high percentage of tubercular animals. The open air and supposedly sanitary conditions on the range are of little avail in restraining tuberculosis in cattle after they once become infected.

The losses to animal industry from bovine tuberculosis are not confined to cattle. Many hogs are fed on skim milk in connection with the dairy business, and in the Middle West hogs "follow" beef cattle. Both result in the dissemination of tuberculosis among hogs to an alarming extent. In 1905 the United States Department of Agriculture inspected 25,357,425 hogs post-mortem, condemning 64,919 carcasses and 142,105 parts.

The importance of bovine tuberculosis, as an economic problem in agriculture, has too frequently been clouded by a discussion of its public health aspects. The incentive for combating the disease has too often come from the health officer. Many dairymen have gathered the impression that the general acceptance of the view that bovine tuberculosis is not a menace to public health would end their difficulties with tuberculosis. The disease will be with us, even if the scientific world does finally agree that the menace to public health from the milk of tubercular cows is slight.

There is no abatement of the demand that milk be produced by healthy cows. Studies of the subject during the past eight years have augmented the evidence that tuberculosis of cattle is transmissible to man. To what extent, is a subject of discussion only. Whether this is eventually shown to be great or small, we shall have the demand, on the ground of sentiment at least, that milk be produced from healthy cows. At the present moment we are witnessing a marked revival of the demand that milk be sold only from cows that have been shown free from tuberculosis by the tuberculin test. The tuberculin-test ordinances in operation are creating a demand for healthy cows. One of the greatest obstacles to their success is the lack of "tested" cows with which to supply the deficiency brought about by the enforcement of the tuberculin test. This gives tested cows a higher market value.

During the past four years we have made tuberculin tests of dairy cows in the various counties of the San Francisco Bay region and in the Sacramento and San Joaquin valleys. In all, 1,976 tests have been made, of which 453 (22.9%) showed reactions. Only four herds, the largest consisting of 39 cows, were free from tuberculosis. A much smaller proportion of isolated cows were affected than those in herds. Of 71 animals, isolated, or in groups of five or less, only 6 (8%) reacted.

A more accurate statement of the prevalence of tuberculosis, as shown by our experience, would be one compiled from results of the tests of whole herds the first time that they had been tested. In this case the figures show 1,022 animals tested, with 326 condemned (31.9%). Tuberculosis was found in 82% of the herds tested.

Few of the herds were particularly suspected of harboring tuberculosis, and most were tested during routine inspections under the auspices of municipalities. They are in the aggregate representative of the dairy cattle producing milk for city trade in the region designated. It should be emphasized that most of these cows were in dairies supplying market milk. The conditions of this branch of the dairy business require that a uniform amount of milk be put out at all seasons. This necessitates the frequent purchase of fresh cows, with the consequent increase of opportunities for the introduction of tubercular infection.

#### THE CONTROL OF TUBERCULOSIS.

Unfortunately, but unavoidably, the early efforts to eradicate bovine tuberculosis were undertaken without a full appreciation of the magnitude of the problem. It was thought that after testing all of the cattle in the suspected herds, killing a few, and disinfecting the stable, the disease would be exterminated. Many dairymen, without compulsion, made honest efforts in this direction. When owners began to experience great losses from the destruction of tubercular animals, the



scheme of compulsory testing, with indemnification by the State, was introduced. With the funds that it has been possible to get from legislatures the work has made pitiful progress as compared with the magnitude of the task. With few exceptions, tuberculosis has succeeded in keeping pace with the puny efforts directed against it. At present, State effort to control tuberculosis is largely confined to those herds where the owner voluntarily submits to the testing of his herd and agrees to coöperate by taking measures to keep his herd clean.

As long as bovine tuberculosis was considered as a public health problem purely, without regard to the financial interests of dairymen, there was a disinclination on the part of the owners to face the facts. The increase of the disease among the cattle in this country, and the better knowledge of its nature, is resulting in a change of attitude. The more progressive breeders and dairymen are appreciating the fact that tuberculosis is an unnecessary and unprofitable adjunct to the business, and many are inquiring about methods of freeing their herds. However, the importance of controlling this disease is as yet inadequately appreciated by the great majority of the owners of live stock. As long as the breeders are content to ignore the presence of the disease and make no effort to combat it systematically, just so long will this plague continue to thrive. We heartily agree with Dr. D. E. Salmon, late chief of the Bureau of Animal Industry, who says, "A disease so widespread can not be controlled unless those most interested in the live stock of the country give active support to the undertaking. It is, therefore, wise to examine the subject in an unbiased manner; to study carefully the nature of the disease; to learn as nearly as possible what the losses are; to what extent these losses are liable to increase, and whether measures of repression are or are not advisable. It is not a question of sentiment, but one of fact, and should be examined as a business proposition."

The possibility of eradicating bovine tuberculosis from herds is a fact demonstrated beyond all question. Its successful accomplishment, however, requires the thorough mastery of the principles governing the spread of the disease. We believe that the dairyman must obtain this information and act upon it in the conduct of his business. This is indispensable whether State aid is available or not. To that end we have prepared this circular to describe methods which have been successful in eradicating tuberculosis from dairy herds.

In the application of any methods for the eradication or prevention of tuberculosis, certain important characteristics of the disease should constantly be borne in mind.

*Its Specific Nature.*—Tuberculosis does not develop spontaneously. The cause of the disease is the bacillus of tuberculosis, which exists only

in the bodies of tubercular animals and their excretions, or in substances contaminated by them. In-and-inbreeding can not produce it. Dark, filthy, badly ventilated stables, poor food and crowded conditions, may contribute to its rapid spread among cattle, but the disease does not originate in an animal, no matter how bad its environments, unless it is exposed to the disease virus.

*Its Infectious Nature.*—Tuberculosis is most readily communicable. This point, in connection with the first, can not be too strongly emphasized. The disease results from the association of tubercular cattle with healthy ones, and under such conditions will spread in spite of every sanitary precaution. It is a mistake to assume that the disease can not thrive and multiply among dairy cattle kept under ideal conditions. The invigorating influence of fresh air and sunshine, wide, well-watered pastures, well ventilated, ideally constructed, immaculately clean barns, and abundant and well-balanced rations will not stop its spread. It is among some of the best kept herds that the disease has been found to be alarmingly prevalent. Contact, direct or indirect, is the chief way in which the disease is disseminated, but calves frequently contract the disease from the milk. Calves and hogs fed on milk from tubercular cows soon become infected. The disease has become in the last few years common among hogs, not only in California, but elsewhere. Many things point to the fact that they contract the disease from the milk and droppings of cattle, and not from one another. In a pig, the disease usually develops more rapidly than in a calf. Professor Russell of the Wisconsin Agricultural Experiment Station has pointed out that although the disease is usually spread from herd to herd by the purchase of tubercular animals from which others of the herd gradually become infected, the relative rate of the spread of the disease by association is not as rapid as the rate of spread produced by the feeding of highly infected milk to calves.

*Rate of Development.*—Different individual animals exhibit the widest variation in the duration of the disease. In the majority of animals the disease pursues a leisurely course, consuming years before causing death. Others develop a rapidly fatal type. Its onset is always unobtrusive, and its progress so gradual that its presence does not inspire apprehension. Losses are so evenly distributed in point of time that they do not excite serious alarm, as do other less destructive diseases of the pestilential type, which kill many suddenly.

*Recognition of Tuberculosis.*—The disease is manifest after death by the presence of tumor-like nodules (tubercles) in various parts of the body. These tubercular masses of long standing undergo changes result-

ing in the formation of purulent, or cheesy material, sometimes permeated with gritty particles of lime.

The presence of the disease is seldom manifest until the development of the tubercles is so great that their presence interferes with the duty of some vital organ. Rough, hard skin, staring coat, emaciation, chronic bloating, roached back, and drooping head only appear in acute or very advanced cases. Coughing is not necessarily an indication. This symptom is usually absent even when the disease is in an advanced stage, and, on the other hand, non-tubercular animals occasionally are troubled by a constant cough. Animals in prime condition may be badly infected, and be quite as dangerous in spreading the disease as those which show the symptoms. A very small percentage of the seriously diseased animals can be detected by a recognition of symptoms. In testing a group of about 380 cows, we condemned 64 as tubercular, on the basis of the tuberculin test. Only 9 showed physical signs of tuberculosis. This observation emphasizes the fact that a physical examination is useless in recognizing any considerable percentage of the tubercular animals in a herd.

Substantial progress in the control of tuberculosis depends upon our ability to unerringly ascertain the existence of any stage of the disease in an individual, as a guide to measures for the prevention of its spread. The tuberculin test does this, and its discovery opened the way to the successful control of tuberculosis. It is a regrettable fact that the phrase "tuberculin test" in the minds of dairymen stands for various systems of compulsory slaughter of cattle, and that it is not esteemed as a discovery of inestimable value to the dairy industry. Its compulsory use, accompanied by wholesale slaughter of animals, has given origin to a host of misconceptions and misrepresentations regarding its accuracy that will hardly be lived down in a generation. In answer to various criticisms, Dr. D. E. Salmon has summed up the accuracy and safety of the tuberculin test as follows:

From the investigations and observations that have been mentioned, it may be safely concluded—

- (1) That the tuberculin test is a wonderfully accurate method of determining if an animal is affected with tuberculosis.
- (2) That by the use of tuberculin, the animals diseased with tuberculosis may be detected and removed from the herd, thereby eradicating the disease.
- (3) That tuberculin has no injurious effect upon healthy cattle.
- (4) That the comparatively small number of cattle which have aborted, suffered in health, or fallen off in condition after the tuberculin test, were either diseased before the test was made or were affected by some cause other than the tuberculin.

The test is simple in its application. It consists in taking the temperature of the animal with an ordinary clinical thermometer several times



to determine its normal, injecting the tuberculin\* with a hypodermic syringe, and then taking the temperature at intervals of two hours between the eighth and eighteenth hours after the injection. Any one with intelligence enough to run a dairy profitably should be able to perform the labor of the test in a competent manner. The animals should be kept under favorable conditions, and care needs to be taken to record accurate temperature readings. In interpreting the temperature records a careful consideration of the conditions under which the test is made and a knowledge of the sources of error is necessary.

*Tests by the Owner.*—The work necessarily has been and must be carried on by those having some knowledge of veterinary science. However, we do not go to the extreme of insisting that the persons performing certain details of the test shall be trained veterinarians. Any intelligent dairyman who will make a little effort to familiarize himself with the test and its limitations can use it on his own cattle with good results. It is only through the coöperation of breeders, dairymen, and veterinarians that there is hope of immediately improving the extremely undesirable conditions which at present exist. When the majority of the dairymen understand the use of the test and the importance of isolating diseased animals, there will be far better prospects of eradicating the disease than if skilled veterinarians are considered indispensable. The expense of employing a professional to perform every detail of the test, is not only often prohibitive, but in many localities no qualified licensed practitioner is available.

The Agricultural Experiment Station of the University of California offers to any dairyman of the State who will avail himself of it the opportunity of learning and perfecting himself in details of using the tuberculin test. Not only can information be obtained, but under conditions to be personally arranged between the inquiring dairyman and the veterinarians of this station, it will undertake to supply free tuberculin and give direct assistance in interpreting the temperature records.

#### THE TESTING OUTFIT.

*Tuberculin.*—Request for University of California tuberculin should be addressed to the Director of the Agricultural Experiment Station,

\* Tuberculin is prepared from glycerinated bouillon in which tubercle bacilli have been grown from six to eight weeks. The bouillon culture is first boiled for two hours to kill all the living organisms. It is then filtered under pressure through a germ-proof earthenware filter to remove the dead bodies of the germs, concentrated by evaporation, a little carbolic acid added, and it is then bottled for distribution. Its injection into cattle affected with tuberculosis is followed in from ten to sixteen hours by a rise of temperature, which lasts several hours, and gradually declines to normal. We can find no evidence that it causes an increase in the rapidity of the progress of the disease in animals already affected with tuberculosis, or that it is injurious to them in any other way. It does not even temporarily injure the quality of the milk.



Berkeley, California, on the form appearing on the last page of this bulletin.

The United States Department of Agriculture also furnishes tuberculin free to health officials. Application for this should be made through Dr. Charles Keane, State Veterinarian, Sacramento, California.

The following firms sell tuberculin ready for use, together with clinical thermometers and hypodermic syringes. Their goods may also be obtained through druggists:

Bischoff & Co., 451 Washington street, New York.

The Cutter Laboratory, Berkeley, California.

H. K. Mulford Co., 412 South Thirteenth street, Philadelphia.

Parke, Davis & Co., Detroit, Michigan.

Pasteur Vaccine Co., 323-325 Dearborn street, Chicago.

*Syringe.*—A veterinary hypodermic syringe of at least 6 cc. capacity, such as is commonly used to inject liquid vaccine, is necessary. The same should be provided with a number of short, stout needles, well reinforced at the base.

*Thermometer.*—At least two fever thermometers will be needed, and where more than five animals are to be tested a larger number should be provided. Guaranteed clinical thermometers can be purchased at any drug store. A string should be tied around the thermometer and fastened by a rubber band. At the other end of this string should be attached a small bulldog clamp or wire hook. After inserting the thermometer in the rectum the clamp is fastened to the long hairs at the base of the tail so that if the thermometer is thrown out it will not be broken by dropping to the ground. Thermometers, especially for veterinary purposes, made of thicker glass and with a ring in the end are convenient.

*Disinfectant.*—A small bottle of strong (95%) carbolic acid to be used in disinfecting the syringe before beginning the test, and to disinfect the needle point before injecting each animal, is essential.

*Vaseline.*—Its use is desirable to facilitate inserting the thermometer, although lard may be substituted. Between the times of taking temperatures the vaseline jar is a safe and convenient place to keep the thermometer.

*Ordinary Green Paint.*—This color is convenient for temporarily identifying animals by numbers placed on the rump. If it is desirable to mark them so that the numbers will not become erased for a week or more, rub the paint well into the hair and it will have a slight blistering effect which will cause the hair to stand up for ten days or so.

## DIRECTIONS FOR MAKING THE TUBERCULIN TEST.

*Identify the Animals.*—Number them with paint or otherwise. It is not advisable for the beginner to attempt to test more than one string (30 animals) at one time.

*Taking the Normal Temperatures.*—A convenient way is to take two temperatures, one at the morning milking and one in the evening, but it is preferable to take two more at two-hour intervals from the others. The last one may just precede the injection of the tuberculin. Familiarize yourself with the reading of the clinical thermometer, and if trouble is experienced, ask your druggist or doctor to show you how. The largest intervals on the scale are degrees, of which every second one only is numbered. The smaller intervals designate 2-10 of a degree. Readings can be made accurately to half of one of these smallest divisions (1-10). Insert the thermometer full length in the rectum. Smear



FIG. 2. Manner of taking the temperature.

the bulb of the instrument and the end of the index finger with vaseline to facilitate the operation. Attach the thermometer to the base of the tail by means of the snap, or a wire hook and rubber band, and allow the thermometer to remain in the rectum three minutes. By the use of this device three or four thermometers may be used, and the temperature of

several animals taken in the time that is required to take one. Be sure and shake down the mercury below 99° F. each time before inserting the thermometer in an animal.

*Temperature of Cattle.*—The usual normal temperature of a milk cow varies between 101° F. and 103° F., but it is not uncommon to find apparently healthy cows that temporarily are even lower or higher than these limits. Excitement may cause a temporary rise, excessive summer heat also increases the normal temperature, while the drinking of cold water may reduce the temperature a degree or two. Most cattle are at their lowest early in the morning and highest in the afternoon. After exposure to a storm or during the severe north winds which sometimes occur in central California, the temperature of the cattle is frequently quite high. The temperature of calves under four months old is much more variable than that of older cattle.

*Treatment of Animals During the Test.*—On account of the ease with which variations in temperatures are caused, it is important to keep the animals, that are being tested, under normal conditions. They should be fed, watered, and milked as usual. Avoid as much as possible the violent handling of nervous cows in taking their temperatures.

*Animals That Should Not Be Tested.*—Cattle suffering from any disease causing a fever (garget, "fox-tail abscess," retained afterbirth, etc.) should not be tested until the fever has subsided. If the cattle have been recently injected with tuberculin, a re-test within one month will be unreliable, and it is safer to allow six or eight weeks to elapse. Most authorities state that the test should not be applied to cows within



FIG. 3. Manner of injecting tuberculin.

four days of calving, or during the period of heat, for fear that these conditions might cause a rise. It is the usual practice to inject all animals, and take the above mentioned conditions into consideration, and re-test if a rise in the temperature does occur.

*Making the Injection.*—This is preferably done in the evening, eight hours before the time of milking in the morning. The syringe should be disinfected by drawing it full of carbolic acid, emptying it, and then rinsing in boiled water before beginning the test. In addition to this, just before injecting each animal, dip the tip of the syringe in strong carbolic acid to disinfect it. Fill the syringe through the needle from the bottle of tuberculin, and avoid contaminating it with dirt. Set the burr on the piston rod of the syringe so that not more than the dose



intended can be injected. The large numbered divisions on the syringe piston rod stand for cubic centimeters (cc.). The size of dose will be stated on the tuberculin bottle. The injection is usually made in the side of the neck where the skin is thin and loose. A fold of the skin is taken in the left hand, and the syringe point inserted in the pocket thus formed and the dose injected. When a cow is restrained in a stanchion the position of the operator shown in figure 3 insures the greatest security from interference or injury by the movements of the cow.

*Temperature After Injection.*—Take temperatures at about the 8th, 10th, 12th, 14th, 16th, and 18th hours after injecting, and continue in those cases showing a rising temperature. Where an animal shows a rise above  $102.5^{\circ}$  F., it is well to take the temperatures at more frequent intervals. In hot weather it is essential that the injection be timed so that the 8th to 16th hours will occur in the cool part of the day.

*Interpretation of the Temperature Records.*—When the tuberculin is furnished by this station the temperature record sheets may be returned as soon as the test is completed, and an interpretation of the results will be made. In case of a reaction (indicating the presence of tuberculosis) there must be a rise of  $1.5^{\circ}$  F. or more above the normal temperature as determined on the preceding day. The interpretation of the temperature record of the animals showing a rise of less than  $2^{\circ}$  F. requires care. The elevation of temperature usually comes on gradually, although in the more pronounced reactions, where the temperature goes above  $105.5^{\circ}$  F., the rise is frequently abrupt. This should usually occur between the 8th and the 16th hours. It should remain practically at a maximum for two hours or more and gradually subside. When the temperature reaches  $104^{\circ}$  F. or more, and is maintained for some hours, the animal is certainly regarded as tubercular, if no fever was shown before the injection. Erratic elevations of short duration do not indicate a reaction. The slight variations caused by the weather, the drinking of cold water, or the irregular handling in applying the test are as apparent in the temperature records of the non-reacting cows as in the others, and a comparison of the temperatures of the animals which show no indication of a reaction should be taken into account in interpreting the records. In case of doubt, the animal should be separated from the herd and re-tested not sooner than a month.

If all conditions pertaining to the protection of the animal have been fulfilled, the temperature behavior mentioned is a very sure indication that the animal is suffering from an active, although possibly a very small tubercular growth. If there is no reaction, the correct interpretation is more difficult. Dr. V. A. Moore, of the New York State



Veterinary College, says that in this case there are three conditions which must be taken into account, viz.:

(1) If the animal is extensively diseased it may, in rare instances, not react. In this case the physical condition would show that the animal was at least not healthy.

(2) If the test was made during the period of incubation there would be no reaction, although the disease may soon develop. (By a period of incubation we mean the time elapsing between the exposure to a disease and its actual development. In tuberculosis this period is very variable. In some cases the disease begins to progress at the day of infection; in others, the germs may be lodged for a long time before the disease actually develops.)

(3) It is known that cows which have reacted, may, because of the natural arrest of the disease, fail to react subsequently; but later the disease would start up again, when the animal would react. Great care must be exercised, therefore, in the interpretation of negative results, especially tests made in herds where tuberculosis exists, and where it is possible that the animals failing to react have been infected.

*Re-testing.*—A single test of a diseased herd can not be depended upon to detect every tuberculous animal. If any animals are found by the first test to be affected, the herd should be tested regularly every six months. On account of the many chances for the infection of a herd the practice of systematic annual testing is recommended for all dairy herds. Animals purchased subject to the test should be re-tested in four or six months. As has already been mentioned, a re-test within a month is unreliable, and when animals are re-tested within six months it is better to use a double dose (4 cc.) of tuberculin.

*Proving the Test.*—The one reliable means of ascertaining the accuracy of the tuberculin test is the slaughter of the animal, and the demonstration of the existence of the disease in the organs. This, necessarily, demands the services of a skilled professional man familiar with the manifestations of the disease, and with the regions in which such manifestations may be located. In some cases animals, not reacting to the test, have been slaughtered on account of serious lung disease with a view to determine if the test had missed a tubercular animal. The manifestations of actinomycosis (lumpy jaw) in the lungs have been mistaken for tuberculosis in such instances.

There is prevalent a popular notion that the failure of an animal to react to the test a second time constitutes a demonstration of the inaccuracy of the test. The falsity of this becomes evident, upon consideration of the facts regarding the result of previous injection of tuberculin, and of the fact that recovery may have occurred in the mean time.

Conversely, criticism of the test and of the honesty and skill of the man applying it, has resulted from the observation of cases in which cattle have failed to react once, and then reacted later without further exposure to infection. The matter is explained by the fact that cows may not develop the disease for months after exposure to the germs

of the disease; or an old center of disease, so nearly healed that it would not give a reaction on the first test, may later have become anew the center of active disease.

#### HOW A DISEASED HERD CAN AT SMALL EXPENSE BE CHANGED TO A HEALTHY ONE.

First, test the entire herd. Successful methods of eradication are all based on the intelligent use of the tuberculin test. After testing, the question arises, "What can be done with reacting animals?" Of course the reacting animals must be at once separated from the healthy in order to stop the spread of the disease.

*If the Tuberculin Test Shows Comparatively Few Affected.*—In this case, segregate the reacting animals at once. It is unquestionably good policy to exterminate the disease by removing the infected animals from the herd, with a view of disposing of the same as soon as circumstances permit. The method formerly and most commonly employed of disposing of reacting animals was by slaughter and burial. Where this wasteful method has been employed the results have been discouraging; even when the State recompensed the owner in part for the loss of his stock, it has been unsatisfactory. A large number of reacting animals are usually but slightly diseased. They readily take on flesh, and can be fattened and used for beef. They must be carefully examined by a veterinarian when killed, and if the disease is found to be extensive, the carcass must be condemned. The government meat inspection regulations admit the use of meat of slightly tuberculous animals for food, for it is recognized that under such circumstances the cooking of meat is an effective safeguard against danger. The University practices what it preaches in this regard. The zeal of various health officials in demanding the waste of the flesh of every reacting animal has been a great setback to the control of tuberculosis through developing opposition.

*The Stable Must Be Thoroughly Disinfected.*—A circular giving directions for the disinfection of stables may be obtained by addressing a postal card request to the Director of the Agricultural Experiment Station, Berkeley, Cal. Many of the failures to eradicate tuberculosis by the repeated application of the tuberculin test, and the prompt removal of all reacting animals, are due to the fact that the stables and sheds were not disinfected. The watering troughs should, of course, be disinfected. That bacilli discharged from the tubercular animals in the corrals may remain virulent for a considerable time is possible, although the action of direct sunshine quickly destroys them. The corrals should, therefore, be thoroughly cleaned of manure.

*If a Large Proportion of the Herd Is Found to Be Diseased.*—In this case if the reacting animals are valuable breeders, they may be isolated and kept for breeding purposes by removing the calves at once and feeding them on milk of healthy cows, or on the sterilized milk of their mothers. This is called the Bang method, a procedure devised by Professor B. Bang, of the Copenhagen Veterinary College. The method is as follows:

- (1) Test every animal in the herd with tuberculin.
- (2) Remove the reacting animals, and keep them isolated so that the disease can not be transmitted to the healthy animals, either by contact, by the attendants, or by the same feeding or drinking utensils.
- (3) Disinfect the stables to prevent transmission of the germs left by the infected animals.
- (4) Test the healthy herd with tuberculin regularly to detect any cases that may develop and remove such animals before they spread the disease. Disinfect again.
- (5) Remove the calves from the diseased herd at birth and feed them milk from the healthy cows, or milk from the diseased cows which has been thoroughly pasteurized (heated to 185° F.).

As the sound herd is replenished, the isolated cattle may, if desired, be fattened and killed, under proper inspection, for beef.

Bang's method, as carried on in Denmark, proves that the disease can be weeded out in a practical manner. But in many of the herds in which the method was tried, a varying number of animals were found that afterward reacted positively to subsequent tests. These partial failures, amounting in all to about 12%, he attributes to carelessness in maintaining complete separation of reacting herds from healthy ones, and incomplete disinfection. The method has been followed by good results in Norway and Sweden, and also in Hungary. The reports show that many highly infected herds have been absolutely freed from the disease in four to six years. Several experiment stations have applied the Bang method in this country. Professor Russell, of Wisconsin, has been especially successful. The New York Agricultural Experiment Station, Geneva, N. Y., has issued a bulletin reporting complete success in the eradication of tuberculosis from the station herd. The method offers a remedy which safeguards health, while giving the stockman a chance to perpetuate valuable strains of blood and mitigate his financial loss.

The problem of obviating the transmission of infection from the reacting herd to the healthy is very important. The two herds must not be permitted to mingle in any way while at pasture or elsewhere. A partition in the stable and new fencing are the chief features in accomplishing the separation. Instances have been reported where the disease has been apparently transmitted to cattle in adjoining pastures. It is possible that this was done by the cows licking one another across the fence. When applying the Bang system the same drinking trough must not be used for the two herds, even when it is divided by a parti-



tion. In highly infected herds the possibility of a continuation of infection in stables, corrals, and pastures, after all the reacting animals have been removed, is relatively greater than when only a few have been diseased. This is especially marked in stables that have been in constant use for a number of years. Where new buildings are erected in introducing the system, it is advisable to place the non-reacting animals there rather than the reacting ones. Remove the healthy from the diseased, rather than the diseased from the healthy.

#### PREVENTION OF TUBERCULOSIS.

Those dairymen who have been doing business in a small way, and have infrequently or never purchased animals, may have herds free from tuberculosis. The trouble of making a test is so slight that one should never neglect ascertaining the facts. Early discovery will enable the owner to forestall serious trouble later. In purchasing cattle a man can not assume that there is a slight risk of purchasing tubercular animals. On the contrary, he must regard every animal as tubercular until the contrary is proven. This will become all the more necessary as the use of the tuberculin test increases. Well-bred animals are particularly liable to show tuberculosis on the test. The herds from which they come have been built up by many purchases from far and wide, with no precautions, which assures the introduction of tuberculosis. An animal purchased on the test should preferably be isolated for three months, and then be tested again before exposing the clean herd to possible infection. As previously explained, one test can not be implicitly relied upon.

The most common method of introducing tuberculosis is probably by the purchase of diseased animals. Next to "buying in" the disease, the feeding of raw skim milk from the creameries is to be blamed. Do not feed skim milk that comes from another herd to calves without first sterilizing it. Prevention is simple. The disease is produced by tuberculosis germs, and if we keep the bacteria away from the cattle they can not possibly develop tuberculosis. Although, experimentally, cattle can sometimes be infected by injecting the virus from tuberculous human beings, it is a question if infection ever takes place naturally.

Vaccination, or the immunization of cattle against tuberculosis, is now being advocated by some scientists. The methods are as yet in the experimental stage, and the effectiveness of vaccination can not be predicted at this time. The California station is testing the von Behring method on a number of calves. The results of these tests will be published later.



# APPLICATION FOR TUBERCULIN.

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*To the Director of the Agricultural Experiment Station, University of  
California, Berkeley.*

SIR:

Application is hereby made for.....:....doses of tuberculin, to  
be used within thirty days, for testing.....head of mature  
animals and.....head of young stock at....., and  
belonging to me.

I agree that in case any tuberculous animals are found in the herd,  
to remove them at once from the healthy portion of the herd, so as to  
prevent further spread of the disease, and not to sell them to any  
person except for immediate slaughter.

I agree that in case tubercular animals are found in the herd, to  
thoroughly disinfect the stable, and agree not to add new animals to  
the herd until they have been proven free from tuberculosis by the  
tuberculin test.

My express address is.....

Mail address, .....

.....

Owner.



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